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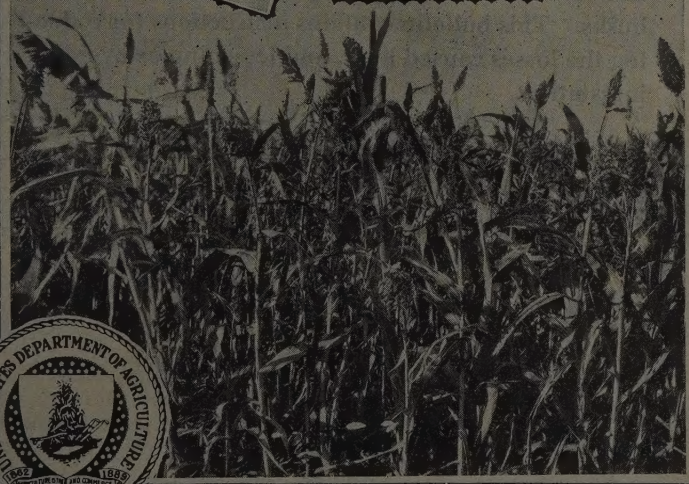
THE SORGHUM MIDGE

with suggestions for control



THE SORGHUM MIDGE costs American farmers a loss of millions of dollars every year in the damage which it inflicts on the grain sorghums, and great losses also in the seed crops of other sorghums, broomcorns, and Sudan grass. The larvae of this insect damage the crop by consuming the plant juices of the developing seeds. The egg is laid in the spikelet of the host plant, and remains there next to the seed while developing through the intervening stages to maturity. Insecticides have not been found practicable for controlling this pest, as there is no known manner of applying them within the seed husks. This bulletin contains instructions for reducing the losses caused by it, and lessening or avoiding infestation.

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THE SORGHUM MIDGE, WITH SUGGESTIONS FOR CONTROL

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IMPORTANCE OF THE MIDGE AND NATURE OF THE INJURY CAUSED BY IT

THE SORGHUM MIDGE[1] is by far the most important insect attacking the grain sorghums. With an annual farm value of about $100,000,000 these crops suffer an average loss of millions of dollars annually through the ravages of this insect. Besides the damage to the grain sorghums great losses from this cause occur in the seed crops of the sweet sorghums, Sudan grass, and broomcorns. In many sections where the sorghum midge is especially abundant a yearly loss of approximately one-fifth of the crop occurs, while in years particularly favorable to the midge these sections produce practically no grain whatever.

The injury caused by the sorghum midge consists in the "blighting" or "blasting" of infested grain. The larvae extract the plant juices from the developing seeds, thus causing them to shrivel and dry. The affected grain, or seed, becomes shrunken and sometimes discolored, giving the infested spikelet an appearance of sterility. The injuries popularly known as "blast" or "blight" may in some cases be due to other causes, but in most instances such injuries are the result of infestation by the midge.

DISTRIBUTION OF THE MIDGE AND PLANTS WHICH IT ATTACKS

The sorghum midge is now well established throughout the principal sorghum-producing sections of the United States. (Fig. 1.) Although serious losses occur in the Central and Eastern States, the greatest injury from this pest is found within its range in the Gulf States.

[1] *Contarinia sorghicola* Coq., order Diptera, family Itonididae.

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No variety of sorghum has yet been found that is resistant to the attacks of the sorghum midge. This insect infests with equal readiness all varieties of the grain sorghums, sorgos (sweet sor-

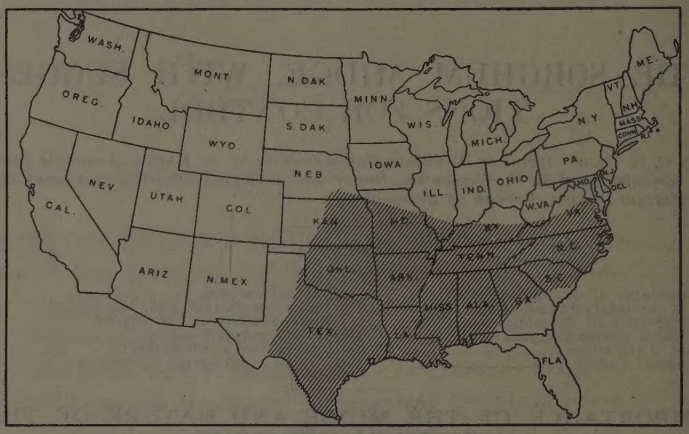

FIG. 1.—Map showing by the shaded portion the known distribution of the sorghum midge in the United States

ghums), broomcorn, Johnson grass, Sudan grass, and tall redtop,[2] the last being a wild grass found plentifully in many of the Southern

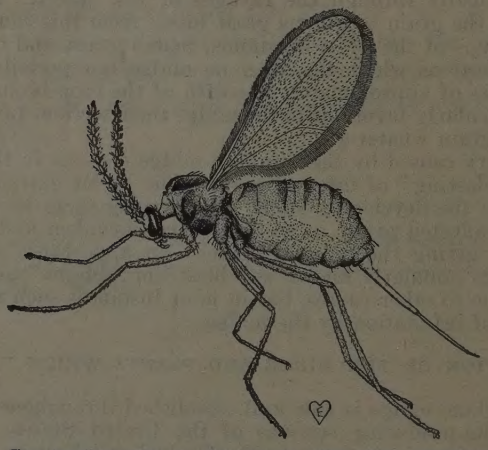

FIG. 2.—Side view of adult female midge, with ovipositor extended. Enlarged 20 diameters

and Eastern States. It is believed that the midge also breeds on other kinds of wild grasses.

[2] *Triodia flava* (L.) Hitchc.

LIFE OF THE MIDGE

If the heads of any of the previously mentioned host plants are examined while in bloom, many small, reddish, gnatlike flies or midges may be found crawling actively over the spikelets of these heads. The flies are the adult females (fig. 2) of the sorghum midge, which are busily laying their eggs within the flowers of the heads. About two weeks later the male flies of these insects have come out and may be found swarming around the same heads awaiting the emergence of the females.

Each female lays approximately 100 tiny white eggs (fig. 3), attaching them to the inner wall of the glumes, or what will become the seed husks. Although not more than one egg is deposited at a time in a given spikelet, it is not uncommon for several females to follow one another in quick succession, in laying eggs within the the same spikelet.

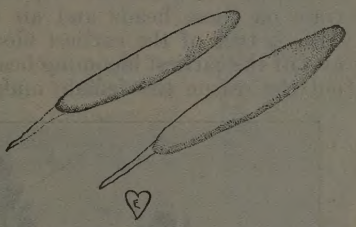

FIG. 3.—Eggs of the sorghum midge. Enlarged 200 diameters. Note the "stem" by which they are attached to the blossom

These eggs hatch in two days, and the resulting small, grayish, maggotlike larvae (fig. 4) establish themselves close to the developing grain and from this they extract their food. When feeding begins the larva turns a pinkish color, which deepens with growth, until at the time of pupation it is a distinct red. The portion of the ovary in contact with the larva shrinks, and the larva is partially enveloped in the resulting shallow, irregular depression. An infestation of one larva per spikelet is sufficient to cause complete loss of the grain (fig. 5, B) but as many as 8 or 10 larvae may develop to maturity on the same seed. The larvae become full grown and pupate in from 7 to 11 days. When newly formed, the pupae (fig. 6) are uniformly red, but the head and appendages soon turn to a dark brown or black. The adults or midges are ready to emerge from the pupal stage at the end of three days. At this time the pupa works its way to the tip of the spikelet, where the skin splits and the adult is liberated. Mating occurs soon after emergence and the females fly to the nearest heads suitable for oviposition. The adults live about two days.

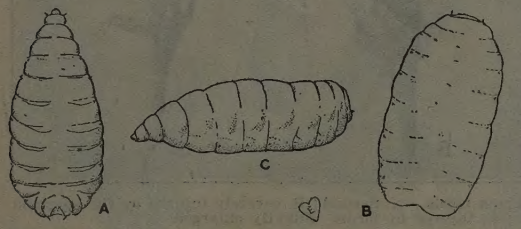

FIG. 4.—Larva of the sorghum midge. A, dorsal view of midge, with proboscis extended; B, same, with proboscis retracted; C, side view. Enlarged 12 diameters

Under normal summer temperatures from 14 to 16 days are required for the complete life cycle. This time varies with the temperature, and is longer in the earlier and later parts of the season, or during cool spells in summer.

SEASONAL HISTORY

The adult flies of the sorghum midge first appear early in the spring at about the time that the Johnson grass and other wild host plants begin to bloom, and in the heads of these plants they lay their first eggs. The flies continue well into the summer to emerge from hibernation. The greatest emergence occurs at about the time the early crop of sorghum is blooming. Where host-plant heads in a suitable condition for oviposition are limited, the females concentrate on these heads and an extremely heavy infestation results. This is true of the earliest blooming host plants in the spring and also of the earliest blooming heads in cultivated sorghums. Throughout the season the female midges lay their eggs very actively and

FIG. 5.—Spikelets of sorghum heads. A, normal; B, severely injured by the sorghum midge; C, injured by birds. Slightly enlarged

may be found doing this on the flowering heads of any available host plants.

Successive life cycles occur throughout the season from the first emergence of hibernating individuals in the spring until the host plants are killed by freezing in the fall. These cycles overlap to such an extent that no well-defined broods are apparent, and all stages of development may be found in the field at any time. One or two cycles usually occur on the volunteer or wild hosts in the early spring, before the cultivated crops bloom.

The midge hibernates as a larva within a puparium in Johnson grass or other host plants. (Fig. 7.) The puparium is brown and resembles the small cocoons of some other insects, owing to the fact

that débris from the spikelet of the host plant adheres to it. As the summer progresses a few of the larvae develop into the hibernating form, but with no apparent regularity. In the fall, however, a larger number of larvae form puparia. Most of the hibernating or overwintering larvae change to pupae and emerge as adults in the following spring, but many of them delay emergence until the second or third spring.

FIG. 6.—Ventral view of pupa of the sorghum midge. Enlarged 34 diameters

NATURAL ENEMIES

Birds, spiders, and insects play their part in keeping the sorghum midge in check. In localities where the midge is plentiful large numbers of spiders are found on the sorghum heads, and more than 20 species have been observed feeding upon adult midges.

The Argentine ant [3] and the small fire ants [4] destroy many midges by swarming over the sorghum heads and seizing the pupae which protrue from the spikelets. They also attack the newly emerged adults before these are capable of flight.

Three tiny wasplike parasites are commonly found associated with the sorghum midge, feeding upon the larvae and pupae. These parasites multiply rather slowly in the spring and only in the latter part of summer do they materially affect the amount of damage inflicted by the midge upon the crop.

FIG. 7.—A, larva of sorghum midge within its cocoon, enlarged 12 diameters; B, exterior views of cocoons, enlarged 7 diameters. A, original; B, after W. H. Dean

IMPORTANT FACTS BEARING ON CONTROL

The most important factor affecting the amount of damage by the sorghum midge is the source of infestation. No serious injury to a field of sorghum can occur unless there is a near-by source from which an influx of female midges may come.

Johnson grass serves as a prolific source for the infestation of near-by fields. (Fig. 8.) When allowed to head, this grass provides an excellent place for hibernation. It blooms very early, thus permitting the individuals first emerging to increase their numbers materially before the sorghum fields come into bloom. Midges continue to breed throughout the season in Johnson grass, thereby making it a constant source of infestation to blooming sorghum fields. (Fig. 9.) The

[3] *Iridomyrmex humilis* Mayr.
[4] Species of Solenopsis.

same is true, although probably to a lesser degree, of the wild grass known as tall redtop, previously mentioned.

Infested sorghum fields from which midges are emerging are serious sources of infestation to adjacent fields when the latter are in bloom.

FIG. 8.—Early Johnson grass, patches of which are known to harbor the sorghum midge

Volunteer and early-blooming host plants may develop in a field some time before the main crop comes into bloom. These early heads are usually heavily infested and may become an important source of infestation to the remainder of the field.

FIG. 9.—Fence line bordering a sorghum field and allowed to become grown up with Johnson grass

Adult midges migrate for a considerable distance from an infested source to the blooming host plants, especially with the help of the wind, which is an important factor in the dispersion of the adults

over near-by fields. Practically all flight is in the direction of the prevailing winds.

RECOMMENDATIONS FOR CONTROL

Owing to the fact that all stages of the midge, with the exception of the adult, are passed within the seed husks, there are at present no practical means of controlling it by the use of insecticides.

TO REDUCE LOSSES

The loss of grain in sorghum fields, due to the midges which come into them from outside sources, can be much reduced by putting into effect the following recommendations:

FIG. 10.—Rows of different varieties of grain sorghum. A, a row of plants upon which heads have not yet emerged. B, a row of plants fully headed out and exposed to attack by the sorghum midge

Locate the field as far as possible from all outside sources of infestation, such as Johnson grass, old sorghum fields, broomcorn, and Sudan grass.

Locate the field so that the prevailing wind blows from the field to be protected toward the most probable source of infestation.

Plant the field at such a date that it will bloom either before or at about the same time as the fields from which infestation is expected or after emergence of midges has ceased in them. (Fig. 10.)

Prior to the development of the grainfields which it is desired to protect, destroy any near-by heads, such as those of volunteer sorghum or wild-grass host plants.

TO LESSEN INFESTATION

The increase in numbers of midges within the sorghum field, owing to successive generations made possible by a long blooming period, may be controlled by the following practices:

Plant only one variety of host plant in the field.

Practice any farm measures which will help to produce a sturdy crop, uniformly developed. A good seed bed should be thoroughly prepared and the best quality of seed of pure strain planted. The date of planting should be such as is considered best for the development of the crop, and the seed should be spaced so as to insure a

FIG. 11.—Heads of sorghum seed, temporarily covered with paper bags for protection from the sorghum midge

good stand and to prevent excessive tillering and lack of uniformity in the development of the heads.

A few days before the main crop blooms, cut all heads of sorghum in the field that are in bloom, or past bloom, remove them from the field and destroy them. This operation will be reduced to the minimum if the previous suggestions as to the use of pure seed and cultural methods have been observed.

Do not allow Johnson grass to form heads in the grain-sorghum field before the sorghum plants bloom and, wherever practical, eliminate it entirely from the farm.

TO AVOID SPRING INFESTATION

Spring emergence of hibernating individuals may be reduced by the following practices:

Burn over the Johnson-grass fields and waste places during the winter months. This will destroy many of the larvae in hibernation.

After harvest rake up and destroy all loose heads in the field.

If the grain is threshed, burn up all refuse that has not been fed to stock by spring.

Small crops of seed can be obtained by tying paper bags over the heads of selected host plants during the blooming season, thus protecting the heads from infestation by the midge. (Fig. 11.) These bags have no effect upon the development of the seed. They may be placed on the heads as soon as the latter are out of the boot, but should be removed shortly after the blooming period, as they produce conditions favorable to the development of the various worms which attack the grain heads.

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